Formosa Journal of Science and Technology (FJST)
Vol. 4, No. 9, 2025: 2701-2714

Exploring Indigenous Knowledge Systems in Sustainable Agricultural Extension Practices

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A R T I C L E I N F O

Keywords: Local Knowledge, Agricultural Extension, Sustainable Agriculture, Agribusiness, Local Wisdom

Received : 7, August
Revised : 21, August
Accepted: 23, September

A B S T R A C T

This study explores the role of local knowledge systems in enhancing sustainable agricultural extension practices by linking local wisdom, innovation adoption, and agribusiness sustainability. Using a mixed methods approach with interviews, focus group discussions, and surveys, findings reveal that traditional practices—such as season-based planting, soil management, and water conservation—remain highly relevant for production sustainability and improve the effectiveness of extension when integrated into learning materials. The study concludes that combining local wisdom with modern extension approaches strengthens sustainable agribusiness theory and offers practical implications for participatory, adaptive, and context-based extension models.

ISSN-E: 2964-6804
DOI: https://doi.org/10.55927/fjst.v4i9.218
https://traformosapublisher.org/index.php/fjst

INTRODUCTION

Sustainable agriculture is currently a major focus in many countries due to global challenges such as climate change, land degradation, and declining agricultural productivity. The world's food system faces serious pressures due to increasing populations, limited resources, and the need to maintain ecological sustainability. International organizations emphasize the importance of combining modern technology with local knowledge-based practices that have long been shown to be adaptive to environmental conditions (Altieri & Nicholls, 2020). In this context, agricultural extension has a strategic role in bringing together these two sources of knowledge in order to create agricultural practices that are environmentally friendly, productive, and sustainable.

In many traditional farming communities, local knowledge passed down from generation to generation continues to play an important role in determining planting patterns, variety selection, and soil and water management strategies. These practices have often proven adaptive to the local climate and ecology because they were developed through long experience and direct observation of the environment (Nyong et al., 2021). Unfortunately, in formal agricultural extension practices, the local knowledge dimension is often poorly accommodated, so the adoption of innovations offered by extension workers is not always effective. This creates a gap between science-based technical recommendations and farmers' habits in the field.

A number of previous studies have shown a significant contribution of local knowledge in supporting sustainable agriculture. For example, a study in South Asia found that farmers who combine traditional soil conservation techniques with modern innovations are able to increase productivity while maintaining long-term soil fertility (Sharma & Singh, 2022). Other research in Africa shows that the neglect of local knowledge in extension actually slows down the adoption of environmentally friendly innovations because farmers feel that extension is not appropriate for their local context (Teshome et al., 2021). These findings confirm that there are still gaps in modern extension models that tend to top-down and have not fully integrated local knowledge systems.

In the Indonesian context, several studies have also shown that the integration of local knowledge with modern extension can increase the effectiveness of the adoption of agricultural innovations. For example, the use of local wisdom in determining planting seasons and nature-based pest control can increase farmers' confidence in extension materials while strengthening their participation in agribusiness programs (Suryana & Hidayat, 2023). However, most of the research in Indonesia is still descriptive and limited to case studies at the local level, so there is not much that directly links the integration of local knowledge with the effectiveness of extension in the framework of sustainable agribusiness.

Previous literature has focused more on the practice of local knowledge as part of environmental conservation or productivity enhancement, while its relationship to sustainable agriculture extension and agribusiness development has rarely been systematically studied. In addition, most studies use a descriptive qualitative approach, so there have not been many studies that combine

quantitative approaches to measure the extent to which local knowledge affects the effectiveness of extension and the sustainability of farming (Kiptot & Franzel, 2021).

Therefore, this study aims to explore the contribution of local knowledge systems in supporting the effectiveness of sustainable agricultural extension practices. In particular, this study examines how local knowledge in aspects of soil, water, and planting management interacts with modern extension methods in influencing the acceptance rate of innovation and agribusiness sustainability. This research also emphasizes the importance of building participatory extension models that are adaptive to the local socio-cultural and ecological context.

The contribution of this research is theoretical and practical. Theoretically, the research enriches the agribusiness literature and agricultural extension by integrating the local knowledge dimension within the framework of sustainable agriculture. Practically, the results of the research can be a reference for extension workers, agricultural institutions, and policymakers to develop more participatory, contextual, and environmentally friendly extension strategies. Thus, this research is expected to be able to strengthen efforts to realize a competitive, sustainable, and inclusive agribusiness system.

THEORETICAL REVIEW

Indigenous Knowledge Systems as the Foundation of Sustainability

Local knowledge systems or Indigenous Knowledge Systems have long been an important part of traditional agricultural practices. SMEs not only include technical knowledge about plant cultivation, but also include ecological, social, and spiritual dimensions that are closely related to the sustainability of people's lives. Recent research shows that local knowledge contributes greatly to food security, especially for smallholder farmers who rely on local resources to deal with climate change and global market pressures (Cavieres et al., 2024). The transmission of SMEs, both through the older generation, communities, and community social media, has been proven to be a determining factor in the sustainability of agricultural practices in traditional communities (Malapane et al., 2024).

Changing the Paradigm of Agricultural Extension

The agricultural extension model has shifted from a top-down technology transfer approach to a participatory approach that emphasizes shared learning. Research shows that group-based learning methods, individual mentoring, and multi-method combinations have been proven to be more effective in increasing the adoption of innovation than a single approach (Cook et al., 2021; Nettle et al., 2024). This paradigm shift provides greater space for the recognition and integration of local knowledge in the agricultural extension system.

Integration of Indigenous Knowledge Systems and Modern Science

The integration of Indigenous Knowledge Systems with modern science not only strengthens the effectiveness of extension, but also increases the legitimacy of extension programs in the eyes of farmers. An effective integration

process requires collaboration in the form of co-creation, i.e. validation of local practices through joint trials and adjustments with agronomic evidence. When SMEs are formally recognized in counseling, the adoption of modern technology by farmers takes place faster and is adaptive to local conditions (FAO, 2024).

Peer Network and Farmer-to-Farmer as the Main Channel of Indigenous Knowledge Systems

One of the main characteristics of the spread of Indigenous Knowledge Systems is the horizontal learning process between farmers. This mechanism provides space for the legitimacy of local knowledge, reduces the risk of trying new practices, and accelerates the diffusion of innovations tailored to the specific needs of the community. Recent research confirms that farmer-to-farmer extension is one of the most effective ways to integrate SMEs into the modern extension system (Cook et al., 2021; Nettle et al., 2024).

Adoption and Preference of Knowledge Sources

Several empirical studies have found that farmers trust local sources of knowledge more than external sources in agriculture-related decision-making. This can be seen in farmers' preferences for traditional leaders, fellow farmers, or traditional practitioners in determining cultivation strategies. However, the literature also emphasizes the importance of connecting SMEs with research, extension, and agricultural input markets to ensure the sustainability of innovation (File & Nhamo, 2023; Nnadozie et al., 2024).

Indigenous Knowledge Systems (SMEs) as a Climate Change Adaptation Strategy

Indigenous Knowledge Systems (IKS) have also proven to be effective as a climate change adaptation strategy. Practices such as natural phenomenon-based planting calendars, agroforestry systems, and traditional water management help farmers adapt to increasingly uncertain climate variability. International reports confirm that indigenous people-based food systems can be a key factor in the transformation towards a more sustainable global food system (Frontiers in Climate, 2022; FAO, 2024).

Implications for Research Design and Extension

Recent literature suggests that research and extension practices place more emphasis on collaboration-based design between local and modern knowledge. Some of the important agendas include evaluating the combination of extension methods, measuring the impact of Indigenous Knowledge Systems on sustainability indicators, and mapping knowledge transmission patterns across generations. The practical implication is the need for a participatory extension model that provides space for local knowledge recognition and involves indigenous institutions in program planning and implementation (Nettle et al., 2024; Malapane et al., 2024).

METHODOLOGY

Types and Approaches to Research

This study uses a mixed methods approach with an explanatory sequential design, which combines quantitative and qualitative methods sequentially. The initial stage of the research was conducted with a quantitative approach through surveys to measure the level of adoption of local knowledge practices in sustainable agricultural extension, followed by a qualitative approach through in-depth interviews and targeted group discussions to explore in more detail the social, cultural, and ecological context of the practice. The selection of this design was based on the need to obtain measurable numerical data as well as a deep understanding of the meaning and relevance of local knowledge in extension practices (Creswell & Creswell, 2021; Guetterman & Fetters, 2022).

Population and Sampling Techniques

The study population is smallholder farmers and agricultural extension workers in the food production center area in Central Sulawesi, Indonesia. The sampling technique uses purposive sampling to ensure the representation of groups who have real experience related to local knowledge practices and their involvement in extension programs. The quantitative sample consisted of 70 farmer respondents selected based on their involvement in sustainable extension, while the qualitative sample involved 30 participants consisting of senior farmers, field extension workers, community leaders and indigenous leaders. This number is considered adequate because it is able to provide a balance between the depth of qualitative information and the adequacy of quantitative data for statistical analysis (Nettle et al., 2024; Malapane et al., 2024).

Data Collection Techniques

Quantitative data were obtained using a structured questionnaire with a five-point Likert scale that measured variables of adoption rates, innovation acceptance, and relevance of local knowledge. This instrument was developed based on indicators used in previous research on sustainable agricultural extension and local knowledge (File & Nhamo, 2023). The validity of the instrument's content was tested through expert judgment by three agribusiness and extension experts, while reliability was measured using the Cronbach's Alpha test with a value limit of ≥ 0.7 as an indicator of internal consistency. Qualitative data were collected through in-depth interviews and focus group discussions (FGDs) with semi-structured interview guidelines, thus allowing for flexible exploration of emerging themes in the field (Cavieres et al., 2024).

Research Procedure

The research stage starts from preliminary studies through field observation and literature review to identify local knowledge practices that are still applied in sustainable agriculture. Furthermore, the preparation of questionnaire instruments and interview guidelines was carried out, followed by instrument trials. Quantitative data collection is carried out through field

surveys, then statistically analyzed. After that, the qualitative stage was carried out through in-depth interviews and targeted group discussions with selected participants to deepen the survey findings. Integration of results was carried out through triangulation of methods by comparing quantitative and qualitative findings to produce a comprehensive understanding of the contribution of local knowledge in sustainable extension (Cook et al., 2021).

Data Analysis Techniques

Quantitative data were analyzed using descriptive statistics to describe the distribution of respondents' answers as well as Pearson correlation analysis to test the relationship between local knowledge utilization, innovation acceptance rates, and agribusiness sustainability indicators. The analysis was carried out with the help of SPSS software version 25. Meanwhile, qualitative data is analyzed using thematic analysis with the help of NVivo 12 software, which allows open coding, categorization, and identification of key themes. The integration of quantitative and qualitative analysis results was carried out with triangulation techniques to increase the validity and reliability of the findings (Nnadozie et al., 2024).

RESEARCH RESULTS

Local Knowledge Adoption Rate

The results of a quantitative survey of 70 respondents show that local knowledge practices are still an integral part of the agricultural systems of the communities in the research area. Data shows that the majority of farmers continue to utilize local wisdom in the decision-making process related to planting seasons, soil management techniques, and water conservation strategies. The highest adoption was found in the determination of planting seasons based on natural signs (82.9%), followed by traditional soil management techniques (74.3%), and locally-based simple water conservation (68.6%). Other practices that are still quite widely applied are the selection of local varieties (61.4%) and traditional agroforestry systems (57.1%).

Table 1. Rate of Adoption of Local Knowledge Practices by Farmers (N=70)

Types of Local Knowledge Practices	Percentage (%)
Determination of planting season based on natural signs	82.9
Traditional land management techniques	74.3
Simple water conservation strategies	68.6
Selection of local varieties	61.4
Traditional agroforestry systems	57.1

The data show that although various modern technologies have been introduced through extension, local knowledge-based practices still have strong

legitimacy among farmers. This is in line with the qualitative findings obtained through in-depth interviews and focus group discussions. Farmers said that the knowledge inherited from previous generations is still considered more contextual, reliable, and in accordance with local agroecological conditions. A senior farmer said: "*We have long been accustomed to seeing signs of nature, such as the position of certain stars or the sounds of nocturnal animals. That is a clue as to when it is time to plant. If you only rely on the official calendar, sometimes you miss it because the season is now uncertain.*" (PS01, Interview, June 12, 2025).

In addition, traditional land management practices are also considered still relevant to maintain fertility. Many farmers continue to use crop rotation patterns, manure, and simple tillage techniques. A field extension worker explained that farmers' attachment to traditional methods is not just a habit, but the result of long experience that has proven to be effective. "*Farmers here believe that the soil has its own way of marking. For example, if the color of the soil starts to pale or a lot of worms come to the surface, they know it's time to be given organic fertilizer. The technique is often more appropriate than the standard chemical fertilizer recommendations from counseling.*" (PL02, Interview, June 18, 2025).

Meanwhile, simple water conservation practices, such as traditional trenching, rain ponds, and bamboo irrigation systems, are also still maintained by most farmers. This practice has been proven to help maintain water availability, especially in the dry season. In an interview, an indigenous leader said that knowledge about water management is not only technical, but also has social and spiritual value, because water is considered a source of life that must be taken care of together, the indigenous leader said: "*Water is not only for plants, but also part of life together. We have customary rules on how to divide water, so that all farmers can share. That's why we still keep the traditional way.*" (TA03, Interview, June 24, 2025).

The Relevance of Local Knowledge to Sustainability

The analysis of the results of the study shows that the local knowledge practices that are still carried out by farmers have high relevance to the sustainability of agricultural production. Quantitative data from a survey of 70 respondents showed that the majority of farmers recognize the important role of traditional practices in maintaining soil fertility, water use efficiency, and reducing the risk of crop failure. As many as 76 percent of respondents considered local knowledge practices to be very relevant in maintaining soil fertility, 71 percent stated that it was important to improve water use efficiency, and 68 percent emphasized that local practices helped in reducing the risk of crop failure. In addition, 64 percent consider local knowledge useful in natural pest control, and 59 percent say it is relevant to maintain agricultural productivity in the long term.

The Pearson correlation test showed a significant positive relationship between the use of local knowledge and the acceptance of modern agricultural innovations ($r = 0.482$; $p < 0.01$). This means that the higher the involvement of farmers in local knowledge practices, the greater their openness to new innovations that are appropriate to the local context.

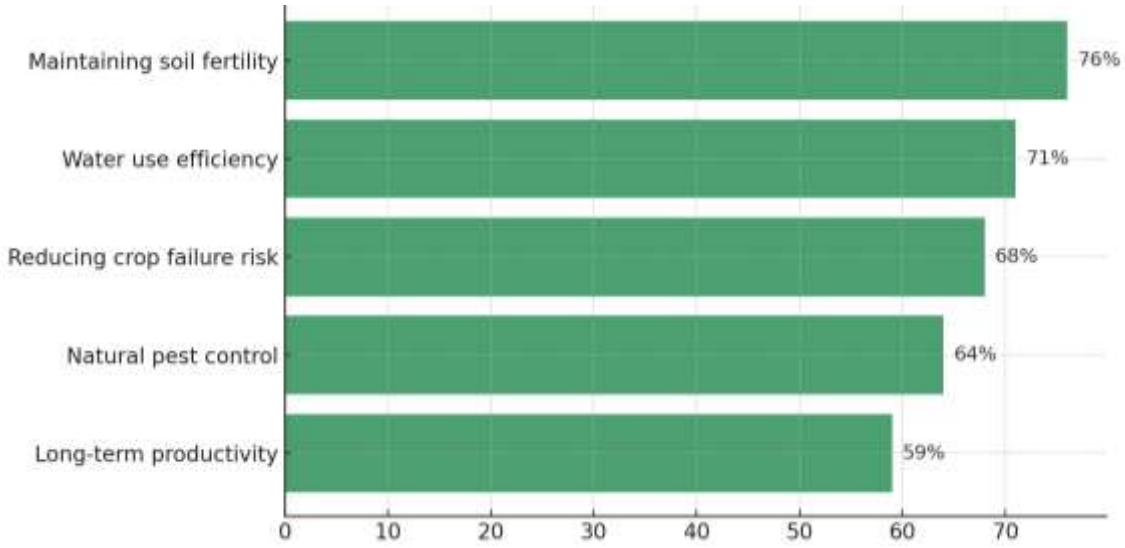

Figure 1. Relevance of Local Knowledge to Sustainability Aspects (%)

These findings indicate that local knowledge is not only seen as cultural heritage, but also has a real contribution to maintaining the ecological, economic, and social dimensions of sustainable agriculture.

Local Knowledge in Maintaining Soil Fertility

The results of in-depth interviews with senior farmers revealed that the use of traditional organic fertilizers, crop rotation systems, and simple tillage techniques have been proven to help maintain soil quality in the long term. Farmers state that this technique is cheaper than chemical fertilizers, while maintaining the balance of the soil ecosystem. A farmer said: "*If the soil continues to be given chemical fertilizers, it will take a long time to be hard and difficult to plant. With manure and crop rotation, the soil remains fertile. That has been proven from the time of our parents.*" (PS04, Interview, June 14, 2025).

Water Use Efficiency

Water conservation through traditional ditches, small reservoirs, and customary rules-based water distribution systems is considered very effective, especially in the face of the increasingly long dry season due to climate change. This system not only functions technically, but also contains a social aspect because it is organized collectively. A community leader stated: "*Water is arranged together, there is an agreed turn. That way all rice fields can still be shared. This system makes farmers less scrambling for each other, and water can be used more efficiently.*" (TM05, Interview, June 20, 2025).

Reducing the Risk of Crop Failure

Farmers also emphasize that local knowledge, especially when it comes to determining planting seasons based on natural signs, helps reduce the risk of crop failure due to uncertain climate change. By observing natural phenomena such as wind direction, animal behavior, or star position, farmers feel better prepared to determine the right planting time. A field extension worker confirms

this: "*When farmers rely on natural signs, they are more careful to plant. That makes the risk of crop failure smaller, because they don't rush to plant before they're really sure the weather conditions are supportive.*" (PL06, Interview, June 25, 2025).

Natural Pest Control

Most farmers still take advantage of local knowledge in pest control, for example by planting certain plants that function as insect repellents or by maintaining the presence of natural predators around the land. This practice is seen as more environmentally friendly, does not cause chemical residues, and helps reduce the relatively expensive cost of purchasing modern pesticides. The results of the interviews showed that farmers had a strong belief in the effectiveness of these traditional methods, although extension workers often encouraged the use of chemical pesticides.

A farmer said: "*We still plant mindi and lemongrass trees on the edge of the rice fields so that there are not too many pests. If you use chemical drugs, the results are indeed fast, but the soil becomes hard and expensive. So we still believe in the old way.*" (P11, Interview, June 14, 2025).

Long-Term Productivity

Although traditional practices in agriculture are often considered simple and less modern, most farmers consider that local knowledge is an important foundation for the long-term sustainability of farming. These practices are not only related to land management, but also include ecological, economic, and social aspects that reinforce each other. From an ecological perspective, local knowledge helps maintain the balance of nature through the use of naturally and sustainably available resources. By not relying entirely on chemical fertilizers or pesticides, farmers feel that soil fertility is maintained, water quality is better, and the biodiversity around farmland is not lost.

From an economic perspective, traditional methods are considered more efficient in production costs. Farmers do not need to spend large expenses to buy modern agricultural inputs, so that farming can continue to run even though the price of fertilizers and chemical pesticides has increased. Meanwhile, from the social side, traditional practices strengthen solidarity between farmers in the community. Through mutual cooperation activities, exchanging seeds, and sharing experiences related to natural signs and pest control, farmers build a solid social system to support agricultural sustainability. This is reinforced by the results of interviews with several respondents. A senior farmer stated: "*If you only rely on fertilizers and chemical drugs, the harvest can be very large. But the soil becomes hard quickly, costs add up, and in the long run it is detrimental. In the way that the ancestors inherited, the yield is sufficient, the land remains fertile, and farming can continue.*" (PS03, Interview, June 18, 2025)

Another farmer emphasizes the social dimension of local practices: "*We are used to working together to manage water, clean channels, or keep rice fields free of pests. It makes the relationship between farmers even closer. So it's not just about the harvest, but also how we keep it together.*" (P06, interview, June 22, 2025). Thus, long-term productivity in the view of farmers is not only measured by the high yield

per season, but also by the sustainability of land ecology, household economic efficiency, and the social strength of the community that supports the agricultural system to survive across generations.

The Relationship of Local Knowledge with Innovation Acceptance

Pearson's correlation test of 70 respondents showed a significant positive relationship between the use of local knowledge and the acceptance of modern agricultural innovations ($r = 0.482$; $p < 0.01$). These findings show that the higher the involvement of farmers in traditional practices, the greater their openness to new innovations, especially when they are communicated in a way that is relevant to agronomic experience and existing local knowledge systems. In other words, local wisdom does not function as an obstacle, but rather as a foundation that strengthens the acceptance of innovation in the community's agricultural system.

These results are in line with the findings in the previous section which showed that local knowledge practices, such as planting season determination based on natural signs (82.9%), traditional land management techniques (74.3%), and simple water conservation strategies (68.6%), still have strong legitimacy among farmers. When modern innovations, such as climate information systems, the use of standardized organic fertilizers, or water-efficient irrigation technologies are introduced through extension approaches, acceptance is higher when they are linked to traditional practices that have been proven to be effective.

Qualitative findings support these quantitative results. In an interview, a field extension worker confirmed: "*If innovations are conveyed without relating to their habits, farmers tend to refuse. But if we show that innovation can reinforce their old practices, it's more quickly accepted.*" (PL03, Interview, June 26, 2025). A similar thing was expressed by a young farmer who began to try to combine traditional techniques with organic innovation: "*We still look at natural signs to determine the planting time, but now we also use information from extension workers about weather forecasts. So it's more certain, because the old method is still used, but there is new knowledge. It makes us feel unfamiliar in a modern way.*" (P07, interview, June 27, 2025).

Both quotes show that counseling based on participation and integration of local wisdom is able to increase the effectiveness of innovation communication. Farmers are more receptive to new technologies when they feel that the innovation is a continuation of ancestral knowledge, rather than something foreign and forced.

Integration of Local Knowledge in Extension Effectiveness

The results of the study show that the integration of local knowledge in agricultural extension has a significant influence on the credibility of extension, the level of farmer participation, and the effectiveness of innovation diffusion. Quantitative data from 70 respondents showed that most farmers were more active in participating in extension programs that combined elements of local wisdom. As many as 81.4 percent of respondents stated that they are more involved in counseling that combines traditional knowledge with modern

innovations, while only 54.3 percent show a high level of participation in modern technical-based counseling alone.

Table 2. Farmer Participation Rate in Extension

Types of Counseling	Participation Rate (%)
Modern technical-based counseling	54.3
Counseling that integrates local knowledge	81.4

Credibility and Trust in Counseling

Qualitative findings through targeted group discussions show that farmers trust extension materials more when local knowledge is recognized and incorporated into the learning process. According to farmers, this makes counseling feel more relevant to their experience, thereby strengthening the legitimacy of extension workers in the eyes of the community. A farmer said: "*If extension workers come and just talk about new technology without connecting it to our old ways, we usually hesitate. But if counseling is linked to our habits, then we are more confident and willing to try.*" (P07, interview, June 16, 2025).

Farmer Participation in the Extension Process

Higher participation in local knowledge integration-based counseling can be seen from farmers' readiness to attend, ask questions, and try new practices. The results of the focus group discussions showed that this approach provides space for farmers to share their experiences, rather than just receiving one-way information from extension workers. Thus, counseling becomes a participatory dialogue forum. A field extension worker confirmed: "*When we set an example that their knowledge is recognized and valued, farmers become more open. They not only sit and listen, but also actively provide feedback and compare their experiences with the information we bring.*" (PL08, interview, June 21, 2025).

Accelerating the Diffusion of Innovation through the Farmer-to-Farmer Mechanism

The integration of local knowledge has also been proven to accelerate the diffusion of innovation between farmers. The horizontal learning mechanism or farmer-to-farmer is the main channel for the dissemination of new practices because farmers are more receptive to innovations introduced through fellow farmers they trust. In many cases, new innovations are adopted faster when they are associated with established traditional practices. A traditional leader said: "*If there are farmers who try new techniques and then combine them with the old way, it usually spreads quickly to other farmers. They believe because it is a real result of their own neighbors.*" (TA09, Interview, June 26, 2025).

DISCUSSION

The results show that local knowledge remains an important part of the agricultural practices of the communities in the research area. The rate of

adoption of local knowledge, such as planting season determination based on natural signs (82.9%), traditional land management (74.3%), and simple water conservation (68.6%), proves that traditional practices still have strong legitimacy despite the introduction of various modern innovations. This is in line with the theory of indigenous knowledge systems which places local knowledge as the result of the accumulation of generational experience that is adaptive to local ecological and socio-cultural conditions (Cavieres et al., 2024).

Furthermore, the relevance of local knowledge to sustainability has proven significant. As many as 76 percent of respondents considered local practices important to maintain soil fertility, 71 percent considered them effective for water efficiency, and 68 percent stated that they were able to reduce the risk of crop failure. These findings confirm the role of local knowledge as a climate change adaptation strategy that has been widely reviewed in the global literature (FAO, 2024; Malapane et al., 2024). Thus, the results of this study strengthen the argument that local knowledge is not just a cultural heritage, but a strategic instrument in facing the challenge of agricultural sustainability.

The Pearson correlation test showed a significant positive relationship between the use of local knowledge and the acceptance of innovation ($r = 0.482$; $p < 0.01$). These results support Rogers' theory of innovation diffusion, which emphasizes that innovation adoption is influenced by compatibility with existing values and practices. Modern agricultural innovations are more acceptable when associated with old practices, such as the use of compostable organic fertilizers positioned as a reinforcement of traditional manure. This is consistent with the findings (Sharma & Singh, 2022) that innovations integrated with local practices increase productivity while strengthening social legitimacy.

The integration of local knowledge in extension also increases the credibility of extension workers and farmer participation. Quantitative data showed that 81.4 percent of farmers were more active in participating in counseling based on the integration of local wisdom compared to 54.3 percent in pure technical counseling. These findings support a new paradigm of participation-based agricultural extension, where the process of co-creation of knowledge between farmers and extension workers increases the sense of ownership of innovation (Nettle et al., 2024). In addition, the farmer-to-farmer mechanism has been shown to accelerate the diffusion of innovation because social legitimacy is higher when innovations are introduced by trusted fellow farmers (Cook et al., 2021).

However, this study also reveals challenges. First, there are still some farmers who are skeptical of modern technology that is considered to ignore traditional values. Second, the limited resources of extension workers in mastering the local cultural context can hinder the effectiveness of integration. Third, the methodology of this study, although using mixed methods, is still limited to one area in Central Sulawesi, so the generalization of findings needs to be done carefully.

The main contribution of this research is to emphasize that the integration of local knowledge and modern innovation is not just a technical strategy, but also a socio-cultural approach that strengthens the sustainability of agribusiness.

Theoretically, this study expands the literature review by linking indigenous knowledge systems to the effectiveness of sustainable agricultural extension. Practically, this study provides recommendations for agricultural extension in Indonesia to develop a participation-based model that respects local wisdom. For further research, it is recommended to expand the scope of the region to look at variations in local knowledge practices between communities and test the effectiveness of integrating local knowledge with specific innovations through a field experiment approach.

CONCLUSIONS AND RECOMMENDATION

This research shows that local knowledge systems still have a very important role in community agricultural practices, especially in maintaining ecological, social, and economic sustainability. Practices such as planting season determination based on natural signs, traditional land management, and simple water conservation are proving relevant in the face of the challenges of climate change and resource limitations. These findings confirm that local knowledge is not only cultural heritage, but also an adaptive instrument that supports the sustainability of agribusiness.

In addition, the results showed a significant positive relationship between farmers' involvement in local knowledge practices and their openness to modern agricultural innovations. Innovation is more quickly accepted when it is associated with existing traditional practices, as farmers feel that the new technology reinforces, rather than replaces, the knowledge of their ancestors. Thus, the integration of local knowledge and modern innovation is key in increasing the effectiveness of sustainable agricultural extension.

Theoretically, this research enriches the discourse on the importance of integrating local knowledge systems in the framework of sustainable agribusiness. Practically, the results of the study provide implications for the development of a more participatory, adaptive, and contextual extension model with local agroecological and socio-cultural conditions. By prioritizing collaboration between modern innovation and local wisdom, agricultural extension can become more inclusive and make a real contribution to strengthening food security, production sustainability, and farmer empowerment at the community level.

FURTHER STUDY

Based on the conclusions of this study, further research is recommended to explore how different types of local knowledge systems can be systematically integrated with specific modern agricultural innovations across various agroecological zones.

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